# 5. Total Maximum Daily Load Total Dissolved Gas

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation (WLA); and nonpoint sources, each of which receives a load allocation (LA). Natural background (NB), when present, is considered part of the LA, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (Water quality planning and management, 40 CFR Part 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the margin of safety is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to humanmade pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First the load capacity is determined. Then the load capacity is broken down into its components: the necessary margin of safety is determined and subtracted; then natural background, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation are completed the result is a TMDL, which must equal the load capacity.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. The load capacity must be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

A load is fundamentally a quantity of a pollutant discharged over some period of time, and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for "other appropriate measures" to be used when necessary. These "other measures" must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying non-point loads and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

## 5.1 In-stream Water Quality Targets

### Design Conditions

Critical time period is during runoff flows, which generally occur between May and July in the Lower Clark Fork River.  Excess TDG is a concern anytime the flows exceed the capacity of hydroelectric facilities and spill occurs. For Cabinet Gorge Dam in Idaho, this is when flows exceed the powerhouse capacity at about 36,000 cfs.

### Target Selection

Idaho has a numeric Water Quality Standard for TDG. TDG levels must not exceed 110% saturation. Therefore, the target for this TMDL is 110% saturation. The water quality standard is based upon literature values that suggest that levels above 110% saturation create the potential for adverse impacts to fish populations, mainly in the form of gas bubble disease. The TDG water quality standard is designed to protect aquatic life. A summary discussion of literature regarding TDG levels and gas bubble disease in fish will be addeed in section 4 of the document.

### Monitoring Points

There are established continuous monitoring points in the Cabinet Gorge forebay and below Cabinet Gorge dam, near the Cabinet Gorge fish hatchery (Parametrix, XXXX). These points will continue to be used as the monitoring points for the TMDL.

## 5.2 Load Capacity

The daily load capacity for the Lower Clark Fork River is set at the water quality standard of 110% saturation.

## 5.3 Estimates of Existing Pollutant Loads

*Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (Water quality planning and management, 40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.*

In conjunction with the relicensing of Avista's Clark Fork and Noxon Rapids hydroelectric projects, and subsequent Settlement Agreement (1999) for operation of the projects and FERC license renewal (2001), monitoring of TDG levels during the spill season has occurred since 1995. A summary of these data and additional references are presented in Appendix X.

While produced by known sources, TDG is considered a non-point source pollutant. There are no point sources in the basin, therefore there are no Wasteload allocations.

The data are extensive, and there is little uncertainty associated with the production of Total Dissolved Gas at hydroelectric facilities during periods of spill. Measurement error of the current instrumentation at designated monitoring points is +/- 2%.
However, background levels of TDG are not known. Therefore, the allocation at the Idaho/Montana border is considered to be an aggregate of background and all other nonpoint source loads of TDG. Existing data indicate that the Montana sources of TDG are occurring above Noxon Rapids Hydroelectric project, as modifications as required by the Settlement Agreement and subsequent Gas Supersaturation Control Plan show no net increase in TDG even during times of spill at Noxon Rapids.

TDG levels are directly correlated with spill volume, and river flow. (See Figure 3-1 Gas Supersaturation Control Plan). For example, when spill volume at Cabinet Gorge dam reaches 10,000 cfs, an increase of 10% TDG is seen, and with spill at 30,000 cfs (river flow 63,000 cfs), an increase of 20% is seen. (Incoming TDG levels at this flow ranged from 105 – 115% at this flow). Once river flow reaches 100,000 cfs, levels below Cabinet Gorge tend to be reach 140%, with forebay levels typically exceeding the 110% standard as well.

**Table X. Current loads from nonpoint sources during Critical Time Period**

| Load Type | Location | Range of Maximum Load | Estimation Method |
|---|---|---|---|
| Non-point and background | Aggregate of non-point source loads in Montana and background | ~ 120% [Range will be reported based on data in Appendix. See Figure 3-1.] | Actual Measurement in Cabinet Gorge forebay |
| Non-point | Cabinet Gorge Dam | ~ 145% [Range will be reported based on data in Appendix. See Figure 3-1.] | Actual Measurement below Cabinet Gorge dam |

## 5.4 Load Allocation

While TDG is a non-point source pollutant, human caused increases in TDG are directly related to the spill at hydroelectric facilities on the Clark Fork River.

The load allocations are determined by the following equation:

$LC = LA_{\text{Idaho/Montana border}} + LA_{\text{Below Cabinet Gorge Dam}} + MOS$

LC = 110% saturation

$LA_{\text{Idaho/Montana border}}$ = 108% at Idaho/Montana Border (aggregate of non-point sources of TDG and background)

$LA_{\text{Below Cabinet Gorge Dam}}$ = 0% Below Cabinet Gorge Dam

MOS = 2%

Based on flow, the reduction required at the Idaho/Montana border ranges from 10-20% to meet the target of 108% saturation at the Cabinet Gorge forebay monitoring point.

Because the Cabinet Gorge dam does not have an allocation, Avista is required to maintain no net increase in TDG levels between monitoring points in the Cabinet Gorge forebay and below the dam to be in compliance with water quality standards. This allocation is consistent with terms and conditions of Idaho's 401 certification of the FERC license for Cabinet Gorge dam.

## Margin of Safety

There is an implicit Margin of Safety in the Water Quality Standard to be protective of aquatic life. In addition, the margin of error of current measurement instruments is +/- 2% (citation), therefore an explicit Margin of Safety is set at 2%.

## Seasonal Variation

The target will not vary seasonally, however, periods of exceedence have only been observed at times of spill, which correlate with spring peak flows. It is possible that due to extenuating circumstances (such as emergency maintenance), spill may occur at other times of the year, in which case the 110% standard will still apply.

## Reasonable Assurance

No net increase in TDG production up to the 7Q10 flow is required by Idaho's 401 certification and the FERC license for the Cabinet Gorge project. The timeline for completing structural modifications required for this reduction in TDG is approximately 10 years (GSCP, 2002). This insures that under most conditions, the target will be met below Cabinet Gorge dam. There are exceedences of Montana's TDG standard of 110% before the border. The state of Montana will provide language on their TDG mitigation efforts.

## Background

Background levels are considered in the aggregate allocation at the Montana/Idaho border.

## Reserve

There is no reserve amount allocated, as no additional sources of TDG are anticipated, or feasible due to the already relatively high exceedences during peak flows.